

*1888*  
Solly (S. E.)

AN

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BY

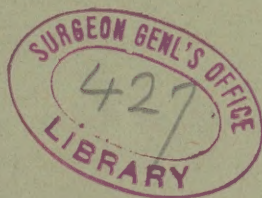
*Compliments of* S. E. SOLLY, M.D.,

PRESIDENT OF THE COLORADO STATE MEDICAL ASSOCIATION ; MEMBER OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION, AND OF THE ASSOCIATION OF AMERICAN PHYSICIANS.

REPRINTED FROM THE

TRANSACTIONS OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION,

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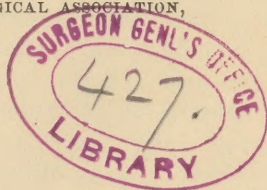
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## AN INVALID'S DAY IN COLORADO SPRINGS.

By S. E. SOLLY, M.D.,  
OF COLORADO SPRINGS.

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ONE of the many difficulties that are encountered by the physician who endeavors to select the best climate for the patient whom he desires to send from home, is the imperfection of the meteorological data at his command. Assuming that he can obtain a record of thermometric and barometric means, of mean velocity and direction of wind, of mean relative humidity, and of total precipitation, he is still very far from gaining a fair estimate of what weather his patient is likely to encounter during the hours of daylight. Yet this is precisely the knowledge most important to obtain. Provided that the house and its accommodations are sufficiently good, the change of climate during the hours of darkness is of very little consequence, comparatively, whilst the atmospheric conditions during the daylight hours are what should chiefly determine the choice of locality. It is with a view of giving this information concerning Colorado Springs, that this paper is presented. I fear, however, that after this preamble, the information being so meagre and imperfect, the oft quoted "*Par-turient montes, nascitur ridiculus mus*" will appear peculiarly appropriate, to typify this labor of the Rocky Mountains. Our means of recording a sufficiency and continuity of observations have been, until recently, so poor, that I am unable to contribute more than a fragment to the stock of information concerning an invalid's day in Colorado Springs. The demand for this knowledge is, however, so pressing, that I feel no apology is needed for giving the best at my command rather than waiting until the record is more worthy of your attention. We have within the last year obtained some self-recording instruments in addition to the ordinary ones in use; from these we expect great things; but as is generally the case with what is new, there have been various accidents which interfered with the taking of continuous and accurate observations. The evidence offered in the tables appended in support of the statements I shall make, is, in spite of the ability, accuracy, and

industry of the Chief of the College Observatory, Professor Loud, very inadequate to support them.

Colorado Springs, a town of some eight thousand inhabitants is situated upon a plateau, 6022 feet above sea level, lat. 39, long. 105. It is about five miles from the foot-hills in which the eastern slope of the Rocky Mountains terminate, and from which the great plains stretch eight hundred miles east to the Missouri River, south to the Gulf of Mexico, and north to the Black Hills. The plateau upon which it is situated is surrounded on three sides by mountains and hills, but lies open to the plains in its southern and southeasterly aspects. The barriers from the wind and weather that this semicircle just described affords, being an average distance of four miles from the edge of the plateau upon which the town is spread, do not detract from its openness, or free exposure to the sun. Pike's Peak, lying to the west, robs it of the direct effect of the last beams in setting but gives a longer twilight than is usual on this continent. The value of this semicircle as a protection from storms is especially in the attraction it affords to the clouds that form upon the Peak, drawing the storms along its ridges to the northeast on one side or the southeast on the other, and thus frequently leaving the plateau free from the rain or snow that forms upon the mountains. The surface of the town site is almost flat with a gradual slope to the South, standing from seventy to twenty feet above the water-courses. There is a top soil of two feet below which are sand and gravel to an average depth of sixty feet, where lies a clay bed which follows the southward trend of the top soil. The soil is, therefore, very dry, nothing but buffalo grass growing without irrigation. The natural drainage is perfect. Water for domestic purposes is brought from the mountains in iron pipes. Trees, shrubs, flowers, and lawns have been planted, and thrive freely with the aid of irrigation. I have divided the invalid's day into the four seasons, in which the hours comprising the day vary as follows, viz., winter day, 9 A. M. to 4 P. M.; spring, 9 A. M. to 6 P. M.; summer, 8 A. M. to 7 P. M.; autumn, 9 A. M. to 5 P. M.; these arbitrary limits being about the average periods during which the invalids are usually out of doors. I will now proceed to sketch in outline the average day in midwinter.

After a night in which there has been a hard frost and a clear sky, with a light breeze from the north, and during which the invalid has usually slept soundly under several blankets, with his window partly open, he wakes up to find the sun shining into his eastern window. And this is a feature which, whatever the weather may be later in the day, is rarely absent. After breakfast, our invalid steps into the



street, being then in an atmosphere in which the heat in the sun is  $92^{\circ}$  F. and in the shade  $30^{\circ}$  F. A gentle air is stirring from the northeast at the rate of eight miles an hour. The mean dew point is 18.

As the day proceeds the temperature rises to its highest point, between 2 and 3 P. M., being  $100^{\circ}$  in the sun and  $40^{\circ}$  in the shade, while the wind, which has veered rapidly from the north to the south, blows with its highest daily velocity, of thirteen miles an hour. After 2 P. M. the wind works back again toward the east, being at sundown northeast, and continuing as darkness falls, to shift back to the northern quarter, whence it blows from 8 P. M. to 9 A. M., its velocity dropping to between seven and eight miles an hour; the temperature of the air at the same time falling from three to four degrees. The ground is usually bare of snow, no rain falls from mid-September to mid-April, and the sun shines unobstructed by clouds. During the three winter months, the cloudy days do not average more than three a month. The effect of such an air is bracing and genial, and being so dry the cold in the shade is very little felt; a medium weight of wrap being all that is needed. The roads are good, and seldom obstructed by snow or mud, and the neighboring hills and plains are full of interesting points to visit, and pleasant sheltered nooks where the invalid can rest under the agreeable heat of the sun, and eat his midday meal without fear of taking cold. The mean rain and melted snow fall combined, for ten years, is 15.87 inches; of this, about twelve inches fall in the spring and summer, leaving about four inches precipitation to occur between September and March. It, therefore, follows that the fall of snow is infrequent and scanty through the winter. Owing to the dryness and porosity of the soil, and the dryness of the air, with the warmth of the almost constant sunshine, the evaporation of the snow is very rapid. In looking at the temperature record it will be noticed that once or more during the winter the temperature will drop below zero, and sometimes a long way below. Such temperatures rarely last, especially during the day, as the sun so seldom fails to shine. When such cold weather occurs during the day, the wind, instead of taking its usual daily course from the north to the south through the eastern quarter, remains in the north, but has a small velocity, a high wind and low temperature being rarely in conjunction. On these exceptional days, the younger and more vigorous invalids go out to exercise with benefit, but the more delicate remain indoors, bearing their captivity with grace, as something that occurs to them only three or four days in the whole winter. Driving is most desirable in the morning, as there is usually very little

wind, but after lunch a strong breeze from the southeast is not uncommon, making walking or riding more pleasant.

In winter, as indeed throughout the year, there is more or less mobility of atmosphere, an absolutely still air being exceptional, but there is seldom in winter sufficient wind to make exercise disagreeable or dangerous, and on the majority of winter days delicate invalids sit out on their porches with pleasure and benefit. Table IX., of comparative velocity, shows that the total annual movement is moderate. And the mean velocity for the year, as shown in Table VI., only 8.58. Table VII. exhibits the mean diurnal variation of wind for a given month, but which is found to be correct for the whole year, the fact being that we have a night wind from the mountains, and a day wind from the plains. We are, as it were, upon a seashore, the plains being the ocean, and the mountains the shore, with a land and sea breeze. The mean direction of the wind at night is north; during the day it is from the south. There occurs once or twice in winter a strong warm west wind which is very apt to follow snow, and to remove it with great rapidity. It is called the "chinook," and is a similar wind to the "Fohn," of Europe, coming, probably, from the Pacific Ocean, and crossing the range. A study of this wind is extremely interesting, but space will not permit its discussion here. The spring weather in Colorado, as in most climates, is the least desirable; during late March and early April the chief part of what snow we have falls, and the wind that goes mainly to swell the total of the annual movement occurs. The "Chinook" is apt to blow occasionally during these months. Early March is generally pleasant. However, even in this season, there are seldom more than two or three days at a time when the delicate invalid cannot go abroad with benefit; and this will not occur more than a few times. The mornings are generally open for exercise, even when the afternoons are blustery. The Spaniards are credited with saying that "a bad Spaniard makes a good Portuguese," so, ruling out the two or three especially bad days, a bad Colorado spring day might be said to make a good spring day elsewhere. There is no regular thawing season, as in the Swiss mountain resorts. During the summer afternoons, thunder showers, lasting twenty minutes or half an hour are common, and it is by these that the bulk of the annual rainfall is made up. The mornings and evenings are rarely anything but bright and pleasant. There is usually during the summer, a week or ten days when it is hot even in the shade, but it is never, even then, equal to the depressing heat on the Atlantic seaboard. During the average summer day the heat, though always scorching under the direct



rays of the sun, if the head is protected, owing to the dryness, is not exhausting; and the shade under the numerous trees is cool and pleasant. A hot night, preventing comfortable sleep, is extremely rare. The absence of dew permits all but the most delicate invalids to sit on the porches in the evening with enjoyment. The autumn weather is peculiarly delightful, being dry and bright, with a pleasant temperature, and very occasional rain or snow. It is almost impossible for those who have never spent a few days at least, in comfortable quarters, at an altitude similar to this, to realize how both great heat and cold are so little felt; and how the great contrast between day and night, sunshine and shadow, is experienced without danger, and what exhilaration and health are given by the bright sparkling air. In short, the reply of a former governor of Colorado to an inquiry concerning the air of Colorado, though apparently bombastic, is scarcely untrue, "Sir, it is elixir to the breath, and velvet to the cheek."

I will not here discuss for whom the climate of Colorado is or is not suitable, but it must be evident from such a presentment of its meteorology that it is very positive in its qualities; is as potential for evil as for good, and that there is no climate where prudence and experience are more needed to realize its benefits, and guard against its dangers. The weather tables which follow, have been kindly compiled at my request, with great accuracy and labor, by Prof. Loud, Chief of the Colorado College Observatory, and by Mr. Sherwood, in charge of the Government Signal Station. The first series, Tables I. to V., relate especially to the Invalid's Day, and the tables, VI. to XV., which follow, to the General Meteorology.

### THE INVALID'S DAY.

In the table of "Principal Meteorological Elements," the columns headed A contain monthly means for *all the days* of the respective months. The columns headed B show the effect upon these means of the omission of five days of each month. Thus under "mean temperature" in column B are given the means for all but five days of each month of summer or winter, the omitted days in summer being the five warmest and in winter the five coldest days. All temperature-means in this table are derived from eye-observations, the thermometer being observed at 7 A. M., 2 P. M., and 9 P. M., and the daily mean obtained by the formula  $\frac{1}{4}[7 + 2 + 9 + 9]$ .

Under "Relative Humidity," column B contains the mean of the remaining days of each month, after omitting the five on which the relative humidity was highest; while under "Dew Point" column B shows the result on the mean dew point of omitting the *same* days which were omitted in the "Relative Humidity" column, *i. e.*, the five moistest days, as estimated by their relative, not their absolute, humidity.

The "days of rain or snow" are those on which the total precipitation (rain or melted snow) was not less than one-hundredth of an inch.

Clear days are those in which the amount of cloud is three-tenths or less of the whole sky-surface; cloudy days those in which this amount is eight-tenths or more; other days are *fair*.

The mean velocity of wind, given in miles and tenths, is the mean of all the hours of each month.

TABLE I.—PRINCIPAL METEOROLOGICAL ELEMENTS FOR THE YEAR  
MAY 1, 1886, TO APRIL 30, 1887.

| 1886.        | Mean Tem-<br>perature. |       | Mean Dew<br>Point. |       | Mean Rel.<br>Humidity. |       | Total<br>pre-<br>cipita-<br>tion. | Days<br>of<br>rain<br>and<br>snow. | Numbe r of<br>days |       |         | Barom-<br>eter at<br>2 P. M. | Wind.<br>Mean<br>velo-<br>city. |
|--------------|------------------------|-------|--------------------|-------|------------------------|-------|-----------------------------------|------------------------------------|--------------------|-------|---------|------------------------------|---------------------------------|
|              | A                      | B     | A                  | B     | A                      | B     |                                   |                                    | Clear.             | Fair. | Cloudy. |                              |                                 |
| May . . .    | 62.5                   | ..... | 31.1               | 29.2  | 34.1                   | 23.2  | 0.12                              | 3                                  | 18                 | 11    | 2       | 24.036                       | 9.8                             |
| June . . .   | 64.4                   | 63.2  | 47.7               | 46.8  | 56.9                   | 52.7  | 3.06 <sup>1</sup>                 | 13                                 | 13                 | 12    | 5       | 24.073                       | 8.3                             |
| July . . .   | 71.8                   | 70.4  | 50.1               | 48.7  | 49.8                   | 44.2  | 2.91                              | 13                                 | 13                 | 13    | 5       | 24.128                       | 7.4                             |
| August . .   | 68.9                   | 67.6  | 54.1               | 53.4  | 61.2                   | 58.0  | 1.39                              | 12                                 | 11                 | 11    | 9       | 24.115                       | 7.1                             |
| September .  | 59.4                   | ..... | 36.0               | 33.9  | 47.8                   | 43.0  | 0.33                              | 3                                  | 18                 | 8     | 4       | 24.054                       | 8.9                             |
| October . .  | 50.6                   | ..... | 28.7               | 27.2  | 46.6                   | 41.8  | 0.28                              | 5                                  | 18                 | 7     | 6       | 24.049                       | 9.4                             |
| November .   | 32.9                   | ..... | .....              | ..... | .....                  | ..... | 0.19                              | 1                                  | 15                 | 8     | 7       | 23.964                       | 10.6                            |
| December .   | 33.5                   | 35.7  | 20.1               | 19.6  | 61.3                   | 56.0  | 0.16                              | 3                                  | 15                 | 9     | 7       | 23.975                       | 9.3                             |
| 1887.        |                        |       |                    |       |                        |       |                                   |                                    |                    |       |         |                              |                                 |
| January . .  | 29.9                   | 33.9  | .....              | ..... | .....                  | ..... | 0.06                              | 2                                  | 14                 | 17    | 0       | 23.816                       | 11.7                            |
| February . . | 31.1                   | 34.3  | 16.5               | 16.5  | 60.1                   | 53.9  | 0.32                              | 3                                  | 12                 | 10    | 6       | 23.851                       | 10.8                            |
| March . . .  | 43.4                   | ..... | 18.5               | 17.6  | 42.4                   | 36.0  | 0.19                              | 2                                  | 9                  | 17    | 5       | 24.001                       | 9.5                             |
| April . . .  | 56.7                   | ..... | 26.2               | 24.8  | 52.2                   | 44.8  | 1.54                              | 9                                  | 8                  | 12    | 10      | 23.909                       | 10.8                            |

<sup>1</sup> On June 2, 1886, some rain, probably not much, was lost by the overflow of the gauge. The precipitation for January, 1887, is estimated, but there can be very little error.

During cold weather in November, 1886, and again in January, 1887, humidity observations were suspended for a week or more each time, so that no means are computed for these months. Their true humidity would probably have been found to be not far from 60 per cent.

TABLE II.—TEMPERATURE OF THE AIR DURING THE WARMER HOURS OF THE DAY, AS DERIVED FROM THE RECORD OF THE DRAPER SELF-REGISTER.

|                 | Number of dates recorded. | 8 A. M. | 9 A. M. | 10 . M. | 11 A. M. | 12 M. | 1 P. . | 2 P. M. | 3 P. M. | 4 P. M. | 5 P. M. | 6 P. M. | 7 P. M. | Mean of "Invalid's day." |
|-----------------|---------------------------|---------|---------|---------|----------|-------|--------|---------|---------|---------|---------|---------|---------|--------------------------|
| January, 1886,  | 29 to 31                  | ...     | 19.7    | 23.3    | 26.9     | 29.2  | 31.1   | 32.6    | 31.5    | 31.0    | .....   | .....   | .....   | 28.2                     |
| February, 1887, | 25 to 27                  | ...     | 30.3    | 34.4    | 37.5     | 40.1  | 42.3   | 44.3    | 44.2    | 44.7    | .....   | .....   | .....   | 39.7                     |
| March, "        | 13 to 15                  | ...     | 41.5    | 44.1    | 45.9     | 48.0  | 49.7   | 52.0    | 54.5    | 53.6    | 52.6    | 50.5    | .....   | 49.2                     |
| April, "        | 24 to 26                  | ...     | 46.6    | 48.9    | 50.7     | 52.4  | 52.9   | 54.4    | 53.6    | 54.0    | 53.6    | 52.1    | .....   | 51.9                     |
| May, "          | 20                        | ...     | 57.0    | 59.1    | 61.4     | 63.2  | 64.3   | 64.8    | 64.7    | 65.2    | 64.4    | 63.2    | .....   | 62.7                     |
| June, 1886,     | 12 to 15                  | 65.7    | 66.7    | 69.1    | 71.8     | 73.1  | 74.3   | 74.4    | 74.3    | 74.3    | 73.6    | 72.5    | 71.2    | 71.8                     |
| July, "         | 29 to 30                  | 73.8    | 75.2    | 77.5    | 79.3     | 80.5  | 81.7   | 81.5    | 80.7    | 79.9    | 78.7    | 77.4    | 75.1    | 78.4                     |
| August, "       | 29 to 31                  | 68.0    | 71.0    | 74.0    | 76.2     | 77.5  | 77.9   | 78.7    | 78.7    | 76.9    | 75.4    | 74.0    | 71.5    | 75.0                     |
| September, "    | 27 to 30                  | ...     | 62.6    | 66.3    | 68.6     | 70.6  | 72.0   | 72.2    | 72.4    | 71.8    | 70.8    | .....   | .....   | 69.7                     |
| October, "      | 29 to 31                  | ...     | 52.2    | 55.4    | 58.8     | 61.3  | 62.8   | 64.1    | 63.8    | 63.3    | 61.0    | .....   | .....   | 60.3                     |
| November, 1885, | 29 to 30                  | ...     | 41.2    | 45.2    | 48.3     | 50.6  | 52.2   | 52.8    | 53.4    | 52.9    | 49.6    | .....   | .....   | 49.6                     |
| December, 1885, | 30 to 31                  | ...     | 31.2    | 37.4    | 40.4     | 43.0  | 44.7   | 45.5    | 45.7    | 44.4    | .....   | .....   | .....   | 41.6                     |

The data for March begin with the 17th, and those for June with the 11th. For May they end with the 20th, the day before the date of compilation. Gaps of less consequence, usually extending over a few hours only, occur in the other months, as indicated in the column "Number of dates recorded."

TABLE III.—SUN-TEMPERATURE.

1. *Average number of hours, and tenths, during which the pencil of the Draper Self-registering Sun-thermometer remained above the mean line of the chart, from March to September, 1886.*

|                              | March. | April. | May. | June. | July. | Aug. | Sept. |
|------------------------------|--------|--------|------|-------|-------|------|-------|
| Average number of hours . .  | 4.8    | 2.3    | 5.8  | 3.7   | 5.6   | 4.9  | 4.1   |
| Number of days in record . . | 31     | 16     | 30   | 18    | 27    | 26   | 25    |

2. *Temperatures indicated by the mercurial sun-thermometer (blackened bulb in vacuo) during the year June, 1886–May, 1887.*

|               | June | July. | Aug. | Sept | Oct. | Nov  | Dec. | Jan. | Feb. | Mar. | April. | May. |
|---------------|------|-------|------|------|------|------|------|------|------|------|--------|------|
| Highest temp. | 137° | 155°  | 152° | 135° | 124° | 110° | 112° | 123° | 114° | 121° | 124°   | 126° |
| Lowest temp.  | 110  | 138   | 133  | 118  | 104  | 94   | 97   | 95   | 101  | 108  | 98     | 101  |

The figures in the last line are not averages, but are determined as nearly as possible so that each has, in its own month, as many of the observed temperatures above it as below it.



TABLE IV.—DIRECTION OF WIND DURING THE WARMER HOURS OF THE DAY, AS DERIVED FROM THE SELF-REGISTERING ANEMOSCOPE.

*Showing the number of times the wind's mean direction was registered in each of eight points of the compass, during an hour of the "Invalid's Day"—that is, from 9 to 4 o'clock in winter, 9 to 6 in spring, 8 to 7 in summer, 9 to 5 in autumn, for the year June, 1886–May, 1887.*

| 1886.               | N.  | N.E. | E.  | S.E. | S.  | S.W. | W.  | N.W. | Direction not registered. | Total. |
|---------------------|-----|------|-----|------|-----|------|-----|------|---------------------------|--------|
| June . . . . .      | 4   | 15   | 11  | 39   | 51  | 11   | 7   | 4    | 218                       | 360    |
| July . . . . .      | 22  | 34   | 16  | 76   | 69  | 14   | 7   | 10   | 124                       | 372    |
| August . . . . .    | 16  | 32   | 12  | 70   | 41  | 28   | 10  | 8    | 155                       | 372    |
| September . . . . . | 33  | 24   | 9   | 124  | 12  | 1    | 21  | 10   | 36 <sup>1</sup>           | 270    |
| October . . . . .   | 25  | 19   | 9   | 143  | 23  | 14   | 10  | 18   | 13                        | 279    |
| November . . . . .  | 37  | 26   | 15  | 85   | 17  | 9    | 19  | 51   | 11                        | 270    |
| December . . . . .  | 22  | 49   | 8   | 86   | 25  | 6    | 10  | 29   | 13                        | 248    |
| 1887.               |     |      |     |      |     |      |     |      |                           |        |
| January . . . . .   | 39  | 20   | 6   | 67   | 18  | 13   | 39  | 35   | 20                        | 248    |
| February . . . . .  | 9   | 20   | 8   | 22   | 85  | 23   | 22  | 26   | 9                         | 224    |
| March . . . . .     | 24  | 21   | 7   | 80   | 32  | 11   | 19  | 16   | 100                       | 310    |
| April . . . . .     | 20  | 7    | 3   | 73   | 6   | 22   | 10  | 25   | 134                       | 300    |
| May . . . . .       | 27  | 11   | 3   | 120  | 26  | 3    | 6   | 4    | .... <sup>1</sup>         | 310    |
| Total . . . . .     | 269 | 268  | 107 | 990  | 405 | 155  | 180 | 236  | 943                       | 2766   |

TABLE V.—MEAN WIND-MOVEMENT IN MILES PER HOUR, FOR THE YEAR 1886, FROM THE ANEMOMETER SELF-REGISTER.

|                     | A. M. |       |        |        | P. M. |      |      |      |      |      |      |
|---------------------|-------|-------|--------|--------|-------|------|------|------|------|------|------|
|                     | 8-9.  | 9-10. | 10-11. | 11-12. | 12-1. | 1-2. | 2-3. | 3-4. | 4-5. | 5-6. | 6-7. |
| January . . . . .   | ...   | 8.5   | 8.5    | 9.4    | 9.7   | 12.7 | 15.8 | 13.0 |      |      |      |
| February . . . . .  | ...   | 7.4   | 7.6    | 9.8    | 12.2  | 11.3 | 13.3 | 16.0 |      |      |      |
| March . . . . .     | ...   | 9.9   | 12.3   | 12.8   | 13.5  | 12.9 | 14.0 | 13.2 | 14.1 | 13.9 |      |
| April . . . . .     | ...   | 8.9   | 9.4    | 11.3   | 22.2  | 12.8 | 13.7 | 14.4 | 14.9 | 14.6 |      |
| May . . . . .       | ...   | 7.0   | 9.0    | 10.3   | 11.4  | 12.1 | 12.1 | 11.8 | 11.8 | 11.4 |      |
| June . . . . .      | 5.0   | 5.4   | 6.2    | 9.4    | 10.7  | 10.9 | 12.5 | 11.1 | 9.7  | 9.1  | 8.9  |
| July . . . . .      | 6.5   | 6.5   | 6.8    | 7.0    | 8.0   | 8.4  | 8.5  | 9.4  | 12.0 | 10.2 | 8.5  |
| August . . . . .    | 3.3   | 4.0   | 5.0    | 6.4    | 8.9   | 10.0 | 10.4 | 9.8  | 7.9  | 9.9  | 9.6  |
| September . . . . . | ...   | 6.9   | 10.0   | 11.1   | 11.4  | 10.6 | 12.1 | 13.5 | 12.5 |      |      |
| October . . . . .   | ...   | 5.7   | 7.7    | 7.4    | 6.3   | 8.4  | 9.7  | 8.8  | 11.1 |      |      |
| November . . . . .  | ...   | 12.5  | 11.2   | 11.2   | 11.4  | 12.2 | 11.9 | 12.2 | 12.5 |      |      |
| December . . . . .  | ...   | 9.9   | 8.7    | 9.0    | 9.2   | 9.3  | 11.0 | 11.0 |      |      |      |

<sup>1</sup> The record of September, 1886, was continuous from the 5th to the end of the month, that for May, 1887, from the beginning to the 20th. The data were compiled May 21st.

## GENERAL METEOROLOGY.

TABLE VI.—MEAN TEMPERATURE.

|                     | At 7 A. M. | At 10-8 A. M. | At 2 P. M. | At 9 P. M. | Day. <sup>1</sup> |
|---------------------|------------|---------------|------------|------------|-------------------|
| January . . . . .   | 17.8       | 27.3          | 36.0       | 20.9       | 24.4              |
| February . . . . .  | 21.3       | 36.3          | 42.0       | 27.1       | 29.4              |
| March . . . . .     | 31.4       | 46.6          | 52.4       | 37.4       | 36.6              |
| April . . . . .     | 38.9       | 50.8          | 54.7       | 42.2       | 43.9              |
| May . . . . .       | 50.2       | 57.9          | 62.9       | 51.7       | 49.9              |
| June . . . . .      | 61.5       | 66.1          | 72.6       | 60.2       | 65.9              |
| July . . . . .      | 66.2       | 75.2          | 77.6       | 65.0       | 67.7              |
| August . . . . .    | 64.9       | 74.3          | 76.9       | 63.6       | 68.1              |
| September . . . . . | 50.1       | 60.4          | 68.8       | 54.2       | 57.2              |
| October . . . . .   | 37.9       | 52.0          | 60.6       | 42.7       | 47.8              |
| November . . . . .  | 27.9       | 43.9          | 48.2       | 31.3       | 35.5              |
| December . . . . .  | 20.2       | 22.8          | 38.2       | 23.2       | 27.6              |
| Spring . . . . .    | 40.2       | 51.8          | 56.7       | 43.8       | 42.8              |
| Summer . . . . .    | 64.2       | 71.9          | 75.7       | 62.9       | 67.9              |
| Autumn . . . . .    | 38.6       | 52.1          | 59.2       | 42.7       | 47.1              |
| Winter . . . . .    | 19.8       | 28.8          | 38.7       | 23.7       | 27.1              |
| Year . . . . .      | 40.7       | 51.1          | 57.6       | 43.3       | 46.4              |

TABLE VII.—MAXIMUM AND MINIMUM TEMPERATURES IN WINTER AND SPRING.

*Maximum temperatures.*

|           | 1873-74. |      | 1874-75. |       | 1875-76. |      | 1877-78. |       | 1878-79. |       | 1879-80. |       | 1880-81. |       | 1882-83. |       |
|-----------|----------|------|----------|-------|----------|------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|
|           | A        | B    | A        | B     | A        | B    | A        | B     | A        | B     | A        | B     | A        | B     | A        | B     |
| December, | 65.0     | 44.1 | 59.0     | 41.7  | 67.0     | 51.6 | 69.0     | ..... | 59.5     | 31.2  | .....    | ..... | .....    | ..... | .....    | ..... |
| January,  | 63.0     | 46.6 | 60.0     | 35.1  | 62.0     | 45.5 | 59.5     | ..... | 68.0     | 37.6  | 62.5     | 46.4  | 63.0     | 40.5  | 55.5     | 36.8  |
| February, | 59.0     | 40.2 | 58.0     | 40.8  | 64.0     | 51.6 | 61.5     | 47.1  | 68.5     | 47.1  | 61.0     | 39.1  | 60.0     | 47.6  | 62.0     | ..... |
| Winter,   | 65.0     | 43.6 | 60.0     | 39.2  | 67.0     | 49.6 | 69.0     | ..... | 68.5     | 38.3  | .....    | ..... | .....    | ..... | .....    | ..... |
| March,    | 61.0     | 48.2 | 67.0     | 42.0  | 65.5     | 49.1 | 70.5     | ..... | 77.0     | 59.4  | .....    | ..... | 70.0     | 51.3  | 67.5     | 54.9  |
| April,    | 82.0     | 53.6 | 71.0     | ..... | 79.0     | 60.8 | 72.0     | 60.4  | .....    | ..... | .....    | ..... | 73.5     | ..... | 70.5     | 56.6  |
| May,      | 92.0     | 74.7 | 84.0     | 70.3  | 84.0     | 67.6 | 80.0     | 63.1  | .....    | ..... | .....    | ..... | .....    | ..... | 80.5     | 66.4  |
| Spring,   | .....    | 58.8 | .....    | ..... | .....    | 59.2 | .....    | ..... | .....    | ..... | .....    | ..... | .....    | ..... | .....    | 59.3  |
| June,     | 101.0    | 85.6 | 91.0     | 82.2  | 93.0     | 77.2 | 84.0     | 71.5  | .....    | ..... | .....    | ..... | .....    | ..... | 90.5     | 76.5  |

NOTE.—Column A contains the highest temperature of the month or season ; column B the mean of the highest temperatures of the several days.

*Minimum temperatures.*

|           | 1873-74. |      | 1874-75. |      | 1875-76. |      | 1877-78. |       | 1878-79. |       | 1879-80. |       | 1880-81. |       | 1882-83. |       |
|-----------|----------|------|----------|------|----------|------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|
|           | C        | D    | C        | D    | C        | D    | C        | D     | C        | D     | C        | D     | C        | D     | C        | D     |
| December, | - 9.0    | 10.6 | - 4.0    | 15.1 | 3.0      | 21.2 | -2.0     | ..... | -15.5    | 5.6   | .....    | ..... | .....    | ..... | .....    | ..... |
| January,  | -15.0    | 14.6 | -25.0    | 3.2  | -3.0     | 12.3 | -5.0     | ..... | -18.0    | 6.5   | -15.1    | 16.1  | -14.0    | 11.3  | -25.0    | 6.8   |
| February, | -17.0    | 11.6 | - 8.0    | 16.1 | -1.0     | 18.8 | 7.0      | 19.6  | - 9.5    | 19.8  | -20.5    | 9.9   | 3.0      | 17.3  | -20.0    | 4.7   |
| Winter,   | -17.0    | 11.9 | -25.0    | 11.5 | -3.0     | 17.4 | -5.0     | ..... | -18.0    | 10.6  | -20.5    | ..... | -14.0    | ..... | 25.0     | ..... |
| March,    | 1.0      | 19.8 | - 4.0    | 16.8 | 3.0      | 18.4 | 13.5     | ..... | 12.0     | 28.6  | .....    | ..... | - 9.0    | 24.0  | 6.0      | 24.2  |
| April,    | 5.0      | 23.5 | 6.0      | 27.9 | 7.5      | 30.9 | 20.0     | 33.8  | .....    | ..... | .....    | ..... | 15.0     | ..... | 19.0     | 31.0  |
| May,      | 27.0     | 41.7 | 26.0     | 42.0 | 26.0     | 40.4 | 30.0     | 40.5  | .....    | ..... | .....    | ..... | .....    | ..... | 26.0     | 38.4  |
| Spring,   | .....    | 28.3 | .....    | 28.9 | .....    | 29.9 | .....    | ..... | .....    | ..... | .....    | ..... | .....    | ..... | .....    | 31.2  |
| June,     | 39.0     | 50.7 | 32.0     | 49.7 | 37.0     | 46.7 | 42.0     | 49.0  | .....    | ..... | .....    | ..... | .....    | ..... | 33.0     | 46.9  |

NOTE.—Column C contains the lowest temperature of the month or season ; column D the mean of the lowest temperatures of the several days.

<sup>1</sup> The daily mean is one-fourth the sum of the readings at 7 A. M., at 2 P. M., and double the reading at 9 P. M.

TABLE VIII.—MAXIMUM AND MINIMUM TEMPERATURES IN SUMMER AND AUTUMN.

|             | 1874. |      |      |      | 1875. |      |      |      | 1878. |      |      |      |
|-------------|-------|------|------|------|-------|------|------|------|-------|------|------|------|
|             | A     | B    | C    | D    | A     | B    | C    | D    | A     | B    | C    | D    |
| June . . .  | 101.0 | 85.6 | 39 0 | 50.7 | 91.0  | 82.2 | 32.0 | 49.7 | 84.0  | 71.5 | 42 0 | 49.0 |
| July . . .  | 98.0  | 89.5 | 48.0 | 55.5 | 90 0  | 76 4 | 47.0 | 53 1 | 90 0  | 83.2 | 48 5 | 67.0 |
| August . .  | 92.5  | 85.5 | 52.0 | 55.4 | 93.0  | 79 7 | 42.0 | 51 6 | 92 0  | 81.5 | 50 0 | 58.3 |
| Summer . .  | 101.0 | 86.9 | 39 0 | 53.9 | 93 0  | 79.4 | 32.0 | 51.5 | 92 0  | 78.7 | 42 0 | 54.8 |
| September . | 87.0  | 71.0 | 27 0 | 42.4 | 88 0  | 73.7 | 27 0 | 44.9 | 82.0  | 69 9 | 33 5 | 43 0 |
| October . . | 76.0  | 63.1 | 20.0 | 38.6 | 82.0  | 68.7 | 18.0 | 35 9 | 79.0  | 61 7 | 13.0 | 32 1 |
| November .  | 65.0  | 52.6 | 2 0  | 24.4 | 74 0  | 52 3 | 9.0  | 24.2 | 66.0  | 51.5 | 5 5  | 25.7 |
| Autumn . .  | ...   | 62.2 | ...  | 35.1 | ...   | 64.9 | .... | 35.0 | ....  | 61 0 | .... | 33.6 |

NOTE.—Column A contains the highest, and column C the lowest, temperature of the month or season; column B contains the mean of the highest, and column D the mean of the lowest, temperatures of the several days.

TABLE IX.—EFFECT UPON THE MONTHLY MEANS OF THE OMISSION OF FIVE DAYS OF EXTREME TEMPERATURE.

|           | COLD MONTHS.              |                       |                           |                       |            | WARM MONTHS.              |                       |                           |                       |
|-----------|---------------------------|-----------------------|---------------------------|-----------------------|------------|---------------------------|-----------------------|---------------------------|-----------------------|
|           | All the days.             |                       | All but five.             |                       |            | All the days.             |                       | All but five.             |                       |
|           | Mean<br>Thermo-<br>meter. | Mean<br>of<br>Minima. | Mean<br>Thermo-<br>meter. | Mean<br>of<br>Minima. |            | Mean<br>Thermo-<br>meter. | Mean<br>of<br>Minima. | Mean<br>Thermo-<br>meter. | Mean<br>of<br>Minima. |
|           |                           |                       |                           |                       |            |                           |                       |                           |                       |
| November, | 35.9                      | 24 7                  | 38.8                      | 27.6                  | May,       | 54.1                      | 70.1                  | 51.9                      | 67.8                  |
| December, | 24.2                      | 14 0                  | 27.2                      | 16.8                  | June,      | 63.7                      | 79 8                  | 62.2                      | 77.7                  |
| January,  | 24 3                      | 8 0                   | 28.2                      | 11.9                  | July,      | 68 4                      | 83 0                  | 67.1                      | 81.6                  |
| February, | 31 5                      | 15.9                  | 34.5                      | 20.0                  | August,    | 67 8                      | 82 3                  | 66 6                      | 80 7                  |
| March,    | 39.7                      | 21.4                  | 42 1                      | 24.1                  | September, | 56.8                      | 71.5                  | 55 0                      | 69.1                  |

TABLE X.—CLOUDINESS AND RAINFALL.

|                     | Average number of days. |       |         | Mean monthly rainfall | Total rainfall.   |
|---------------------|-------------------------|-------|---------|-----------------------|-------------------|
|                     | Clear.                  | Fair. | Cloudy. |                       |                   |
| January . . . . .   | 19                      | 9     | 3       | 0.17                  | 1872 . . . 6.79   |
| February . . . . .  | 15                      | 11    | 2       | 0.20                  | 1873 . . . 2.91   |
| March . . . . .     | 15                      | 12    | 4       | 0.68                  | 1874 . . . 9.95   |
| April . . . . .     | 13                      | 13    | 4       | 1.23                  | 1875 . . . 2.45   |
| May . . . . .       | 11                      | 13    | 7       | 2.65                  | 1876 . . . 4.98   |
| June . . . . .      | 13                      | 12    | 5       | 1.87                  | 1879 . . . 4.39   |
| July . . . . .      | 14                      | 14    | 3       | 3.65                  | 1883 . . . 2.55   |
| August . . . . .    | 13                      | 13    | 5       | 2.40                  | 1872 . . . 10.81  |
| September . . . . . | 20                      | 8     | 2       | 1.78                  | 1873 . . . 10.46  |
| October . . . . .   | 24                      | 6     | 1       | 0.29                  | 1874 . . . 1.92   |
| November . . . . .  | 19                      | 8     | 3       | 0.52                  | 1875 . . . 10.28  |
| December . . . . .  | 18                      | 9     | 4       | 0.43                  | 1878 . . . 8.24   |
| Spring . . . . .    | 39                      | 38    | 15      | 1.52                  | 1872-3 . . . 1.11 |
| Summer . . . . .    | 40                      | 39    | 13      | 2.64                  | 1873-4 . . . 3.10 |
| Autumn . . . . .    | 63                      | 22    | 6       | 0.86                  | 1874-5 . . . 4.86 |
| Winter . . . . .    | 52                      | 29    | 9       | 0.27                  | 1875-6 . . . 4.15 |
| Year . . . . .      | 194                     | 128   | 4       | 1.32                  | 1878-9 . . . 4.80 |

NOTE.—The "rainfall" includes melted snow.



TABLE XI.—WIND.

*Proportionate frequency of winds from the several points of the compass.*

|                 | At 7 A. M. |    |    |    |    |    |   |    | At 2 P. M. |    |    |    |    |    |    |    |
|-----------------|------------|----|----|----|----|----|---|----|------------|----|----|----|----|----|----|----|
|                 | N          | NW | W  | SW | S  | SE | E | NE | N          | NW | W  | SW | S  | SE | E  | NE |
| January . . .   | 44         | 31 | 11 | 2  | 0  | 3  | 4 | 5  | 25         | 18 | 4  | 1  | 8  | 31 | 9  | 4  |
| February . . .  | 42         | 26 | 6  | 1  | 3  | 4  | 3 | 15 | 20         | 9  | 12 | 8  | 12 | 27 | 6  | 6  |
| March . . .     | 36         | 20 | 7  | 2  | 2  | 9  | 4 | 20 | 5          | 9  | 15 | 7  | 18 | 37 | 4  | 5  |
| April . . .     | 32         | 26 | 8  | 9  | 3  | 10 | 4 | 8  | 14         | 13 | 14 | 11 | 15 | 26 | 2  | 5  |
| May . . .       | 38         | 17 | 3  | 2  | 13 | 15 | 6 | 6  | 10         | 14 | 7  | 9  | 25 | 28 | 3  | 4  |
| June . . .      | 33         | 17 | 1  | 8  | 11 | 11 | 7 | 12 | 10         | 8  | 0  | 5  | 18 | 47 | 6  | 6  |
| July . . .      | 36         | 40 | 2  | 0  | 4  | 10 | 2 | 6  | 7          | 10 | 7  | 11 | 13 | 32 | 13 | 7  |
| August . . .    | 45         | 21 | 4  | 0  | 8  | 9  | 0 | 13 | 12         | 28 | 5  | 3  | 13 | 22 | 10 | 7  |
| September . . . | 38         | 41 | 1  | 3  | 0  | 6  | 0 | 11 | 4          | 14 | 4  | 10 | 8  | 45 | 7  | 8  |
| October . . .   | 55         | 28 | 3  | 1  | 4  | 1  | 4 | 4  | 6          | 6  | 5  | 6  | 24 | 39 | 13 | 1  |
| November . . .  | 55         | 28 | 5  | 2  | 2  | 5  | 2 | 1  | 21         | 12 | 6  | 4  | 11 | 34 | 10 | 2  |
| December . . .  | 48         | 33 | 7  | 1  | 3  | 3  | 3 | 2  | 20         | 14 | 7  | 3  | 13 | 39 | 2  | 2  |
| Year . . .      | 42         | 27 | 5  | 3  | 4  | 7  | 3 | 9  | 13         | 13 | 7  | 6  | 15 | 34 | 7  | 5  |

|                     | At 9 P. M. |    |    |    |    |    |   |    | Mean<br>velocity,<br>miles per<br>hour. |
|---------------------|------------|----|----|----|----|----|---|----|-----------------------------------------|
|                     | N          | NW | W  | SW | S  | SE | E | NE |                                         |
| January . . . . .   | 35         | 31 | 11 | 1  | 4  | 4  | 3 | 11 | 9.74                                    |
| February . . . . .  | 22         | 22 | 18 | 3  | 2  | 12 | 4 | 17 | 10.30                                   |
| March . . . . .     | 16         | 32 | 9  | 2  | 6  | 16 | 9 | 10 | 10.06                                   |
| April . . . . .     | 30         | 20 | 9  | 8  | 7  | 10 | 7 | 9  | 11.69                                   |
| May . . . . .       | 26         | 17 | 11 | 5  | 11 | 16 | 7 | 7  | 9.82                                    |
| June . . . . .      | 21         | 30 | 10 | 3  | 7  | 17 | 5 | 7  | 8.33                                    |
| July . . . . .      | 17         | 29 | 6  | 10 | 8  | 13 | 4 | 13 | 6.77                                    |
| August . . . . .    | 32         | 36 | 9  | 0  | 3  | 12 | 3 | 5  | 6.37                                    |
| September . . . . . | 34         | 30 | 8  | 1  | 11 | 9  | 5 | 2  | 7.48                                    |
| October . . . . .   | 40         | 33 | 5  | 5  | 2  | 9  | 3 | 3  | 7.31                                    |
| November . . . . .  | 37         | 45 | 2  | 2  | 4  | 4  | 2 | 4  | 7.93                                    |
| December . . . . .  | 39         | 32 | 9  | 3  | 1  | 13 | 3 | 0  | 7.10                                    |
| Year . . . . .      | 29         | 30 | 9  | 4  | 5  | 11 | 5 | 7  | 8.58                                    |

TABLE XII.—MEAN DIURNAL VARIATION OF WIND IN VELOCITY AND DIRECTION, MARCH, 1883.

| Time.                       | Velocity. | Progress. | Direction.   |
|-----------------------------|-----------|-----------|--------------|
| Midnight to 2 A. M. . . . . | 8.7       | 6.1       | N. 17° 9' E. |
| 2 A. M. " 4 " . . . . .     | 8.5       | 5.8       | N. 11 " 3 E. |
| 4 " " 6 " . . . . .         | 9.6       | 7.7       | N. 11 56 E.  |
| 6 " " 8 " . . . . .         | 8.4       | 6.8       | N. 6 18 E.   |
| 8 " " 10 " . . . . .        | 6.9       | 3.9       | N. 24 32 E.  |
| 10 " " 12 M. . . . .        | 10.4      | 4.6       | N. 79 47 E.  |
| 12 M. " 2 P. M. . . . .     | 12.5      | 6.1       | S. 61 25 E.  |
| 2 P. M. " 4 " . . . . .     | 12.5      | 6.4       | S. 52 54 E.  |
| 4 " " 6 " . . . . .         | 11.3      | 4.9       | S. 60 14 E.  |
| 6 " " 8 " . . . . .         | 6.6       | 2.6       | S. 69 43 E.  |
| 8 " " 10 " . . . . .        | 7.6       | 2.4       | N. 62 19 E.  |
| 10 " " midnight . . . . .   | 8.2       | 3.3       | N. 46 51 E.  |

TABLE XIII.

|                                | Eleva-<br>tion. | Barome-<br>ter. | Mean of 5 years |       |         | 4 years.                   | 10 years.           |                           | Prevailing<br>winds.   |
|--------------------------------|-----------------|-----------------|-----------------|-------|---------|----------------------------|---------------------|---------------------------|------------------------|
|                                |                 |                 | Number of days  |       |         | Relative<br>humid-<br>ity. | Yearly<br>rainfall. | Mean<br>temper-<br>ature. |                        |
|                                |                 |                 | Clear.          | Fair. | Cloudy. |                            |                     |                           |                        |
|                                | Feet.           | Inches.         |                 |       |         |                            |                     |                           |                        |
| Colorado Springs, <sup>1</sup> | 6050            | 24.06           | 194             | 128   | 43      | .....                      | 15.87               | 46.4                      | N and SE, <sup>2</sup> |
| Denver, Colo.                  | 5294            | 24.77           | 177             | 142   | 46      | 45.8                       | 14.77               | 49.1                      | S.                     |
| Santa Fe,                      | 7046            | 23.26           | 174             | 148   | 41      | 41.4                       | 14.17               | 48.5                      | E and SW               |
| Los Angeles,                   | 350             | 29.64           | 164             | 148   | 51      | 65.8                       | 18.97               | 59.8                      |                        |
| Salt Lake,                     | 4348            | 25.60           | 141             | 131   | 93      | 40.3                       | 17.52               | 51.8                      | NW and SE.             |
| Jacksonville, Fla.             | 43              | 30.03           | 126             | 152   | 87      | 69.0                       | 55.94               | 69.2                      |                        |
| Augusta, Ga.                   | 183             | 30.14           | 123             | 150   | 92      | 69.2                       | 48.98               | 64.2                      |                        |
| Newport,                       | 34              | 29.95           | 108             | 140   | 111     | 74.3                       | 50.20               | 50.3                      |                        |
| Boston,                        | 142             | 29.84           | 105             | 145   | 115     | 68.5                       | 49.47               | 48.5                      | W.                     |
| Chicago,                       | 661             | 29.31           | 104             | 154   | 107     | 69.2                       | 35.47               | 49.3                      | SW.                    |
| St. Paul,                      | 811             | 29.13           | 103             | 158   | 104     | 67.3                       | 29.59               | 43.9                      | SE.                    |
| New York,                      | 164             | 29.85           | 101             | 155   | 109     | 70.2                       | 42.70               | 51.3                      | NW.                    |

TABLE XIV.—COMPARATIVE VELOCITY.

*Total annual movement.*

| Year—April, 1878, to March, 1879. |         | Year—January to December, 1880. |        |
|-----------------------------------|---------|---------------------------------|--------|
| Colorado Springs                  | 70,912  | Newport, R. I.                  | 84,885 |
|                                   |         | San Francisco, Cal.             | 82,724 |
| Year—January to December, 1880.   |         | St. Paul, Minn.                 | 76,096 |
| Cape May, N. J.                   | 134,455 | New York, N. Y.                 | 74,642 |
| Milwaukee, Wis.                   | 110,924 | Chicago, Ill.                   | 74,192 |
| Philadelphia, Pa.                 | 92,211  | Jacksonville, Fla.              | 57,333 |
| St. Louis, Mo.                    | 90,927  | San Diego, Cal.                 | 55,062 |
| Boston, Mass.                     | 85,704  |                                 |        |

TABLE XV.

| DAVOS PLATZ. |        |       |         | COLORADO SPRINGS. |        |       |         |
|--------------|--------|-------|---------|-------------------|--------|-------|---------|
|              | Clear. | Fair. | Cloudy. |                   | Clear. | Fair. | Cloudy. |
| October      | 11     | 12    | 8       | October           | 24     | 6     | 1       |
| November     | 14     | 7     | 9       | November          | 19     | 8     | 3       |
| December     | 16     | 8     | 7       | December          | 18     | 9     | 4       |
| January      | 19     | 9     | 3       | January           | 19     | 9     | 3       |
| February     | 16     | 8     | 5       | February          | 15     | 11    | 2       |
| March        | 18     | 7     | 6       | March             | 15     | 12    | 4       |
| Total        | 94     | 51    | 38      | Total             | 110    | 55    | 17      |

The Davos observers divide the days into cloudless, constant sunshine, which I have grouped as coming under the head of clear in the Colorado observations. Clouds and sunshine, as fair; cloudy days, days when there were showers of rain or snow, wet or snowy days, all have been classed under cloudy days and compared. The Davos observations, which were all I could obtain, were for 1879, 1880, 1881, while the Colorado Springs figures are from several years' observations.

<sup>1</sup> The data for Colorado Springs are taken from the preceding tables, and the number of years' observations from which each is obtained is stated in the letter which accompanies them.

<sup>2</sup> North at night; S E in the middle of the day and afternoon.









